PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing (*day/month/year*) 05 JAN 2006	
Applicant's or agent's file reference 036180/PCT	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date (*day/month/year*)	Priority date (*day/month/year*)
PCT/US04/38145	15 November 2004 (15.11.2004)	14 November 2003 (14.11.2003)

International Patent Classification (IPC) or both national classification and IPC

IPC(7): G01V 3/00 and US Cl.: 324/309

Applicant

NEW YORK UNIVERSITY

1. This opinion contains indications relating to the following items:

- ☒ Box No. I — Basis of the opinion
- ☐ Box No. II — Priority
- ☐ Box No. III — Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV — Lack of unity of invention
- ☒ Box No. V — Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI — Certain documents cited
- ☐ Box No. VII — Certain defects in the international application
- ☐ Box No. VIII — Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(*b*) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/ US	Date of completion of this opinion	Authorized officer
Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	22 November 2005 (22.11.2005)	Jeremiah Shipman Telephone No. (571)272-8439

Form PCT/ISA/237 (cover sheet) (April 2005)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US04/38145

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ on paper

☐ in electronic form

c. time of filing/furnishing

☐ contained in the international application as filed.

☐ filed together with the international application in electronic form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US04/38145

Box No. V Reasoned statement under Rule 43 *bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-22	YES
	Claims NONE	NO
Inventive step (IS)	Claims 9-18 and 21	YES
	Claims 1-8 and 19-20	NO
Industrial applicability (IA)	Claims 1-22	YES
	Claims NONE	NO

2. Citations and explanations:

Please See Continuation Sheet

Supplemental Box
In case the space in any of the preceding boxes is not sufficient.

V. 2. Citations and Explanations:

Claims 1-8, 19-20, and 22 lack an inventive step under PCT Article 33(3) as being obvious over the applicant's admitted prior art (admission) in view of Devito et al (US Patent No 5,421,331).

Regarding claims 1, 19, and 22, applicant admits as known the conventional method for manually prescribing radial slice planes for MRI along a long-axis of a target (Specification, page 2, line 6), comprising acquiring vectorial components for a short-axis slice of the target (page 1, lines 21-27; page 2 lines 2-5-"acquiring vectorial components for a short-axis slice" means defining the short-axis slice and defining SS, PE, and RO directions. The conventional method described here includes imaging short-axis slices, which inherently requires first defining the slice (and then defining SS, PE, and RO directions (vectors) associated with the slice). Thus the known manual procedure has included the step of acquiring vectorial components.), establishing vectorial components for a long-axis slice using the vectorial components of the short-axis slice (page 1, lines 24-27; page 2, lines 7-10, 23-27-the known manual method includes the step of defining 8-10 uniformly angularly spaced long-axis slices which are perpendicular to the short-axis slice and encompass the region imaged in the short-axis slice. "Establishing vectorial components" once again means defining the position and orientation of the slices, including defining their SS, PE, and RO vectors. The definition (vectorial components) of these long-axis slices depends on the definition (vectorial components) of the short-axis slice, hence the vectorial components of the long-axis slice are established using the vectorial components of the short-axis slice.), and defining a plurality of long-axis slice planes positioned relative to the long-axis slice, each of the slices being rotated about a long-axis in a direction of a long-axis frequency encoding vector (page 2, lines 23-27; page 1, lines 24-28). The admission does not expressly show automating the process, or a computer-readable medium comprising instructions for carrying out the hitherto manually carried out steps. Devito et al. disclose a method and computer readable medium comprising instructions for carrying out the method in a related medical imaging art (col 1, lines 31-37; a computer performing the method as described by Devito et al. must inherently read instructions from some sort of computer readable medium comprising those instructions) for automating a hitherto manually preformed process (col 1, lines 44-54) of defining the long-axis of the heart (col 1, lines 55-57) and defining imaging slices according to this determination (col 2, lines 8-12). Devito et al. are solving the same problem applicant is addressing-the reduction of human error in the medical imaging process (col 1, lines 39-44; col 4, lines 22-28) and the freeing up of the medical technician's time (col 1, lines 51-54) through automation of determining the long-axis of the heart and defining imaging slices using this determination. It would have been obvious to one of ordinary skill in the art at the time of the invention to apply the teachings of Devito et al. to the conventional method described by the applicant, in order to gain the advantages as described by Devito et al., namely the reduction of human error (col 1, lines 39-44; col 4, lines 22-28) and the freeing up of the medical technician's time (col 1, lines 5-54) through automation.

Regarding claims 2 and 3, applicant admits as conventional the step of obtaining a short-axis image among the short-axis slice of the target (page 2, lines 2-5), and admits as implicit in the process of prescribing a slice the definition of vectorial components, such as the SS vector, the PE vector, and the RO vector (page 2, lines 7-9).

Regarding claims 4-6, and 20, it is admitted as known that the long-axis slice will be perpendicular to the short-axis slice

Supplemental Box
In case the space in any of the preceding boxes is not sufficient.

(that is, that their SS vectors are orthogonal), and that the RO vector of the short-axis slice is parallel to the long-axis (page 1, lines 24-28). The known method includes any orientation of the vectorial components of the long-axis slice that satisfy this orthogonality condition (page 1, lines 24-27), which includes the one defined by transposing the short-axis vectorial components. Regarding claim 5, an instance of this is transposing the SS and RO directions of the short-axis slice would result in the SS direction of the long-axis slice being in the plane of the short-axis slice (perpendicular to the SS direction of the short-axis slice), and the RO (frequency encoding) direction of the long-axis slice being parallel to the long-axis ("down the barrel" of the heart), in accordance with the conventional method (page 1, lines 27-28). Regarding claim 6, "establishing vectorial components of the long-axis slice by transposing the SS and RO directions of the short-axis slice" *means* "defining a long-axis frequency encoding vector (R_0) as a short-axis slice selection vector ($R_0 = S'$) and defining a long-axis slice selection vector (S_0) as a short-axis frequency encoding vector ($S_0 = R'$)". The limitation $P_0 = P'$ is a consequence of the transposition and the known definition that the PE direction is normal to both the SS and RO directions (page 2, lines 10-11. Actually, P_0 may equal either P' or $-P'$ according to the admission's prior art.), hence the discussion of claim 5 also applies to claim 6.

Regarding claim 7, it is admitted as conventional to manually define a plurality of long-axis slice-planes rotating about a frequency-encoding direction (page 1, lines 24-28; page 2 lines 23-27).

Regarding claim 8, the claim limitations describe defining a series of n uniformly angularly-spaced long-axis planes (each with perpendicular SS and PE directions, and each sharing a common readout direction) all passing through the long-axis of the heart, rotated about the RO direction (the long axis, "down the barrel of the heart"). The acquisition of such a series of uniformly angularly spaced long-axis slice images is admitted as conventional in the manual method (page 1, lines 24-28; page 2, lines 23-27-for example, n is equal to 8 or 10).

Claims 9-18 and 21 meet the criteria set out in PCT Article 33(2)-(3), because the prior art of record does not teach or fairly suggest the determining of frequency and phase shifts for each of the long-axis slices in combination with the other limitations of the claims.

Claims 1-22 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Xu et al. (US 5,699,799) discuss an automated technique for determining the long axis of a body organ; they also provide evidence that it is known in the art that techniques used in SPECT imaging can also be used in MR imaging (col 3, lines 31-41). Haselhoff (US 6,038,466) discusses an automated technique for determining the long-axis of the heart, and then determining the short axis from this. Hardy (US 5,512,827) and Darrow (US 5,584,293) discuss interfaces for manually prescribing slice geometry. Keren et al. (US 4,710,716) discuss the acquisition of oblique slices.